REQ. NO. 1-9127

CONTRACT REPORT NO. OSQ 81-00181

Production of a Peabody F14,1-0-75-F9 Hz Burner Fuel Tip and Assessment of Performance for Coal Liquid Mixture Combustion

Final Report

Energy, Mines and Resources
555 Booth Street
Ottawa, Ontario K1A 0G1

Attention: Dr. H. Whaley
Scientific Authority

DSS File No. 18SQ.23440-1-9127

ORF Contract No. 36001

D. GIANNINI
DEPARTMENT OF ENGINEERING AND METALLURGY

6th August 1982

ONTARIO RESEARCH FOUNDATION

SHERIDAN PARK RESEARCH COMMUNITY
MISSISSAUGA, ONTARIO, CANADA L5K 1B3 • (416) 822-4111 • TELEX 06-982311

10 pp

WE, THE ONTARIO RESEARCH FOUNDATION, STIPULATE THAT THIS DOCUMENT IS SUBJECT TO THE FOLLOWING TERMS AND CONDITIONS:

1. ANY PROPOSAL CONTAINED HEREIN WAS PREPARED FOR THE CONSIDERATION OF THE ADDRESSEE ONLY. ITS CONTENTS MAY NOT BE USED BY NOR DISCLOSED TO ANY OTHER PARTY WITHOUT OUR PRIOR WRITTEN CONSENT.
2. ANY TESTING, INSPECTION OR INVESTIGATION PERFORMED BY US WILL BE CONDUCTED IN ACCORDANCE WITH NORMAL PROFESSIONAL STANDARDS. NEITHER WE NOR OUR EMPLOYEES SHALL BE RESPONSIBLE FOR ANY LOSS OR DAMAGE RESULTING DIRECTLY OR INDIRECTLY FROM ANY DEFAULT, ERROR OR OMISSION.
3. ANY REPORT, PROPOSAL OR QUOTATION PREPARED BY US REFERS ONLY TO THE PARTICULAR MATERIAL, INSTRUMENT OR OTHER SUBJECT REFERRED TO IN IT. NO REPRESENTATION IS MADE THAT SIMILAR ARTICLES WILL BE OF LIKE QUALITY.
4. NO REPORT ISSUED BY US SHALL BE PUBLISHED IN WHOLE OR IN PART WITHOUT OUR PRIOR WRITTEN CONSENT.
5. OUR NAME SHALL NOT BE USED IN ANY WAY IN CONNECTION WITH THE SALE, OFFER OR ADVERTISEMENT OF ANY ARTICLE, PROCESS OR SERVICE.
6. WE RESERVE THE RIGHT NOT TO COMMENCE AND OR CONTINUE ANY WORK UNTIL PAYMENT ARRANGEMENTS SATISFACTORY TO US ARE ESTABLISHED.

PRODUCTION OF A PEABODY F14,-1-0-75-F9 HZ BURNER FUEL TIP AND ASSESSMENT OF PERFORMANCE FOR COAL LIQUID MIXTURE COMBUSTION

FINAL REPORT

Department of Energy, Mines and Resources
555 Booth Street
Ottawa, Ontario K1A 0G1

This report covers the wear evaluation tests conducted on a nitrided Peabody fuel tip. The test program consisted of the following analyses:

1. Weight Loss Analyses
2. Micro Photographic Analyses
3. Mass Flow Resistance Analyses

1. * Weight Loss Analyses

The weight of the fuel nozzle tip was measured before and after combustion tests using a Mettler scale with a 1×10^{-5} gram resolution. The procedural error was determined to be 0.02 mg by repeating the procedure a number of times. Prior to weighing the fuel tip, a cleaning procedure was followed.

2. * Micro Photographic Analyses

Individual microphotographs of the fuel tip were taken before and after testing (see Figure 2). A fuel tip holder assembly was designed to ensure that photographs were taken at the right angle of the orifices. Hole size and areas for each individual orifice photographed were determined using a planimeter and an average for the fuel tip was calculated.

3. * Mass Flow Resistance Analyses

The facility shown schematically in Figure 1 was used to evaluate the mass flow of water through the burner fuel tip at a constant pressure and temperature.

The fuel tip was placed in a specially designed adaptor fixture and connected to the piping network. The pressure was maintained at 5 psig and 60°F. The mass flow of water over a five minute period was collected and weighed. This procedure was repeated and an average flowrate determined.

RESULTS

The test results are given in Table I and show that the flow rate increased by 18.4% while the area increased by 18.0%.

The surface hardness of the Peabody fuel tip remained at 70 R_c both prior to and after testing (see Figure 1 for location of surface hardness measurement).

D. Giannini
Technologist II
Dept. of Engineering & Metallurgy

DG:df
6th August 1982

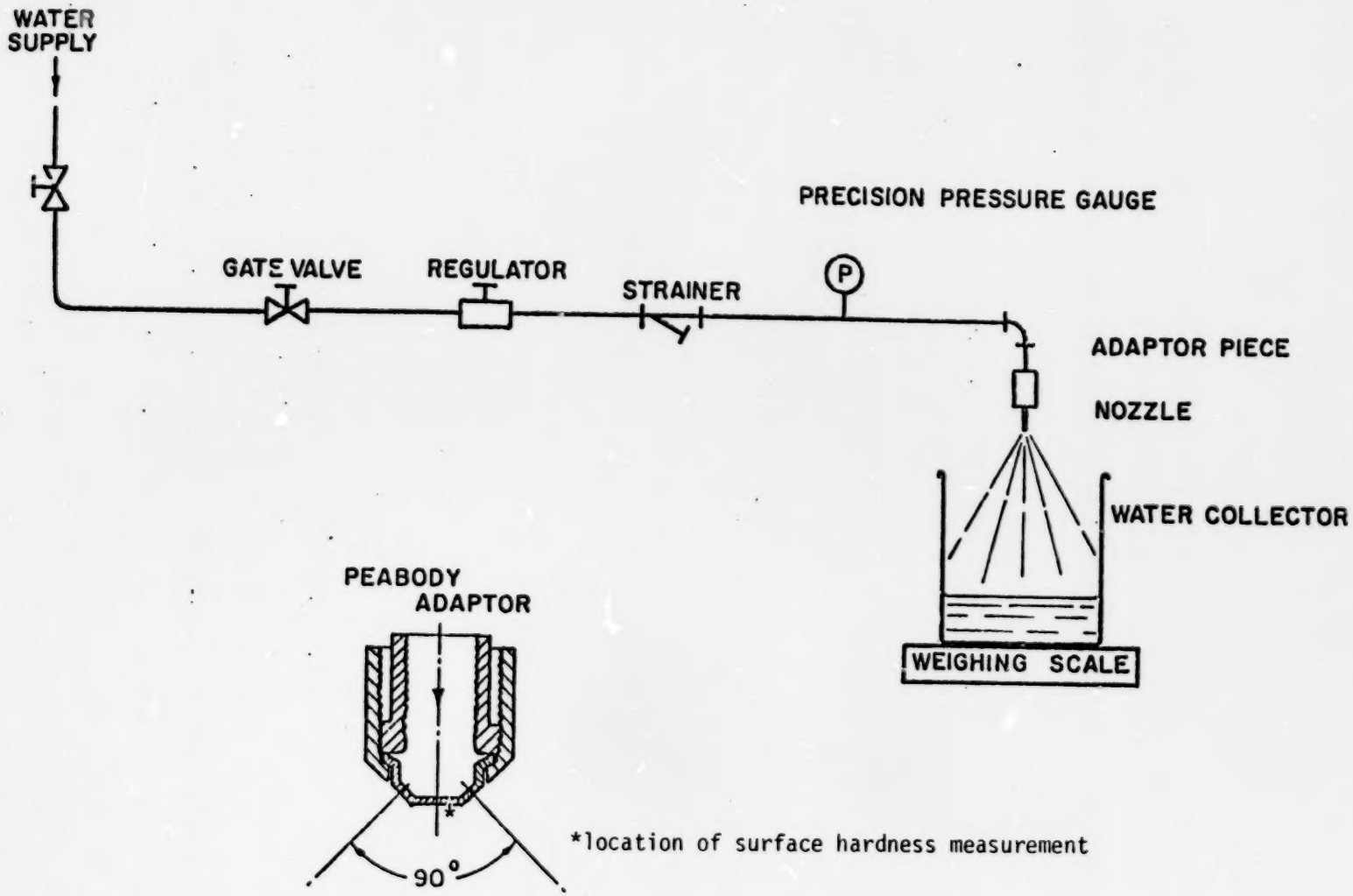


FIGURE I - MASSFLOW RESISTANCE ANALYSIS TEST FACILITY

TABLE I

TEST RESULTS

	March 29, 1982				July 28, 1982			
Nozzle Weight gms (lbs)	40.6308 (.089576)				40.5240 (.08934)			
Average Flow Rate kg/hr (lbs/hr)	645.9 (1424)				764.8 (1686)			
Hole Number	Hole Diameter mm (in)		Hole Area mm^2 (in^2)		Hole Diameter mm (in)		Hole Area mm^2 (in^2)	
1	2.052	(.0808)	3.307	(.00513)	2.256	(.0888)	3.997	(.00619)
2	2.055	(.0809)	3.307	(.00513)	2.245	(.0884)	3.958	(.00614)
3	2.065	(.0813)	3.349	(.00519)	2.253	(.0887)	3.987	(.00618)
4	2.063	(.0812)	3.343	(.00518)	2.215	(.0872)	3.853	(.00597)
5	2.060	(.0811)	3.333	(.00516)	2.268	(.0893)	4.040	(.00626)
6	2.063	(.0812)	3.343	(.00518)	2.205	(.0868)	3.819	(.00591)
7	2.050	(.0807)	3.301	(.00512)	2.215	(.0872)	3.853	(.00597)
8	2.060	(.0811)	3.333	(.00516)	2.220	(.0874)	3.871	(.00601)
9	2.060	(.0811)	3.333	(.00516)	2.256	(.0888)	3.997	(.00619)
10	2.060	(.0811)	3.333	(.00516)	2.238	(.0881)	3.934	(.00609)
Avge.	2.057	(.0810)	3.323	(.00515)	2.238	(.0881)	3.934	(.00609)

NOTE: All flow tests conducted at 60°F water temperature and 5 psig

Flow rate increase % = 18.4

Area increase % = 18.0

FIGURE 2 . PHOTOGRAPHS OF THE PEABODY BURNER FUEL TIP ORIFICES BEFORE AND AFTER TESTING (30 x Mag.)

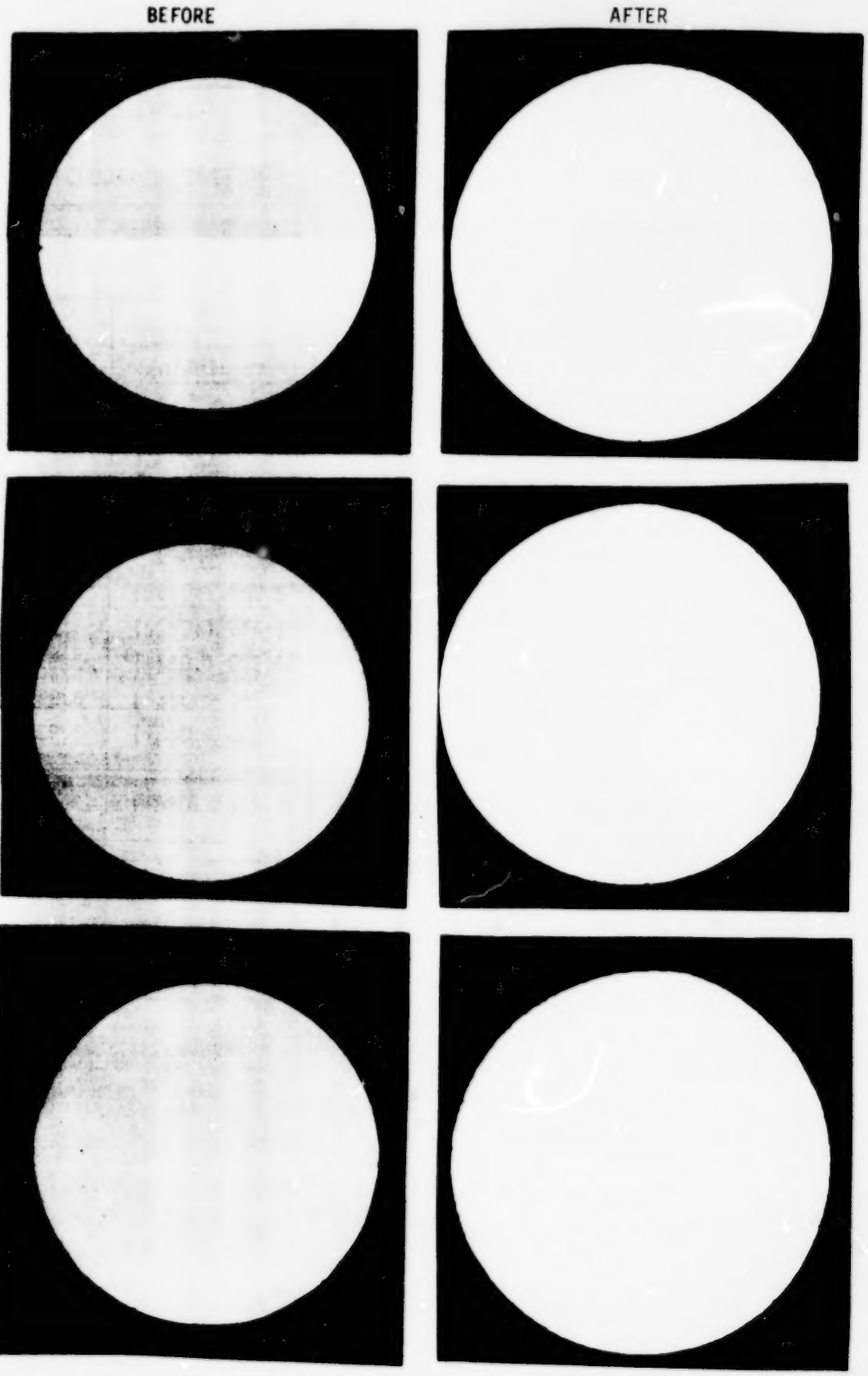


FIGURE 2 (Con't)

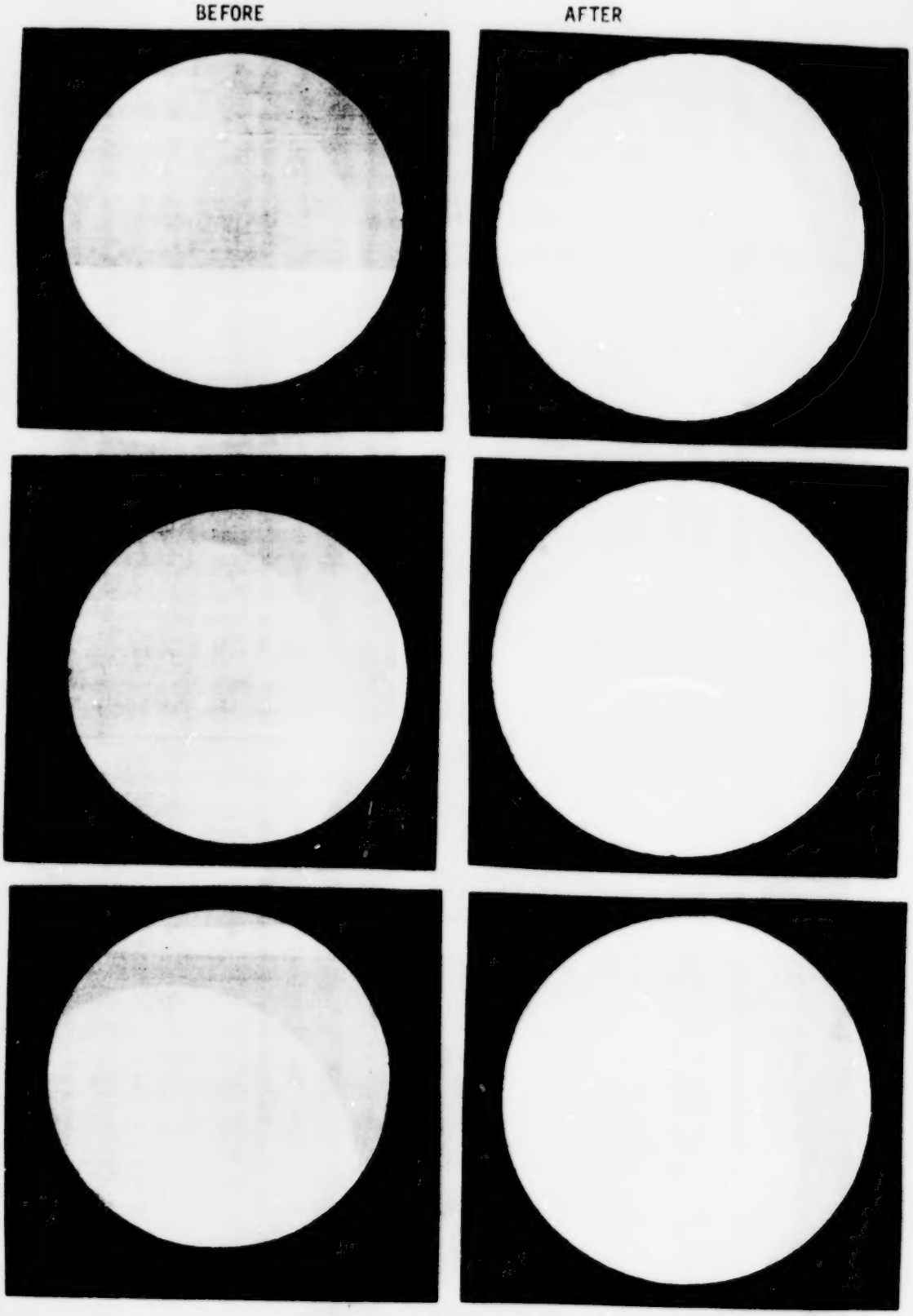


FIGURE 2 (Con't)

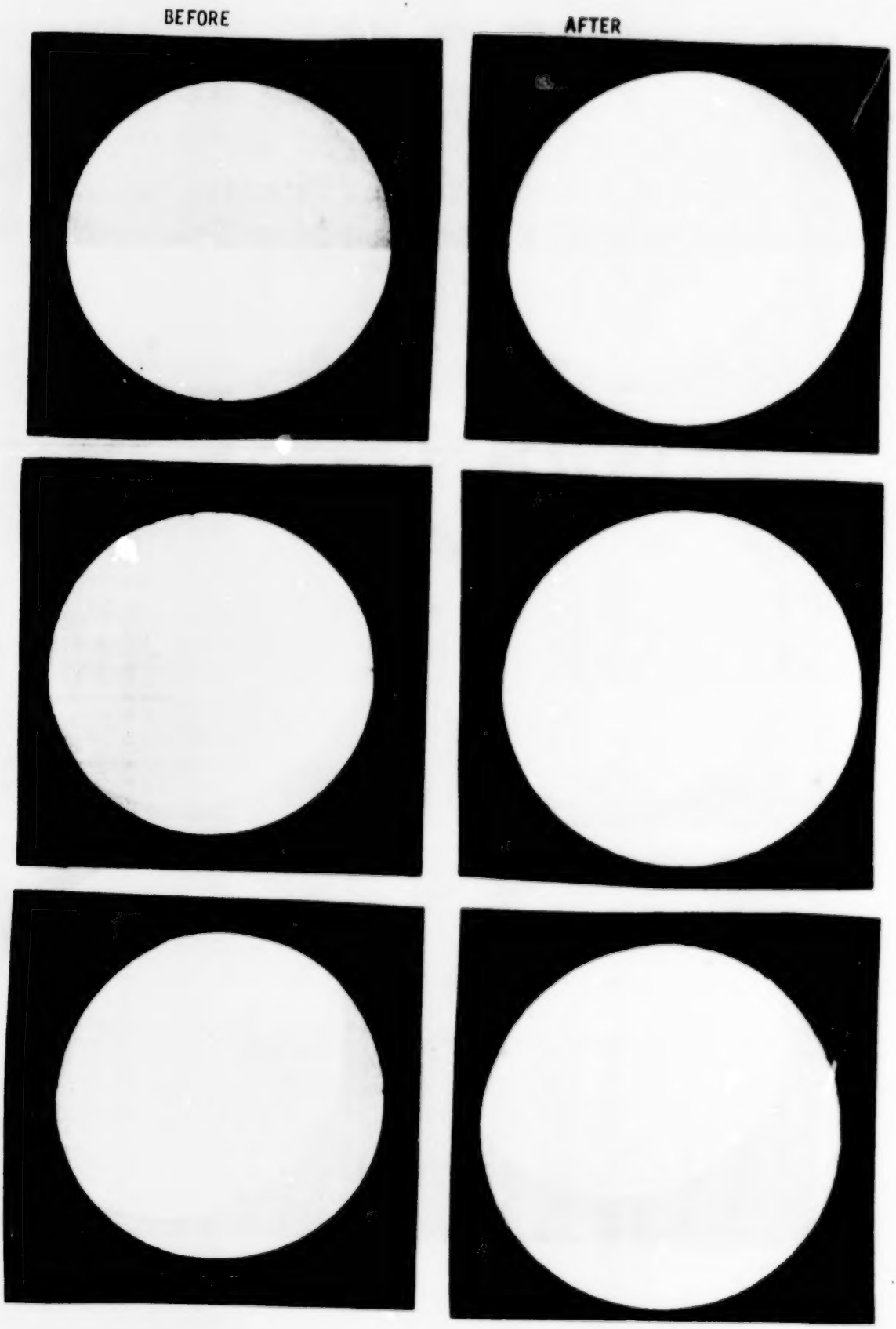
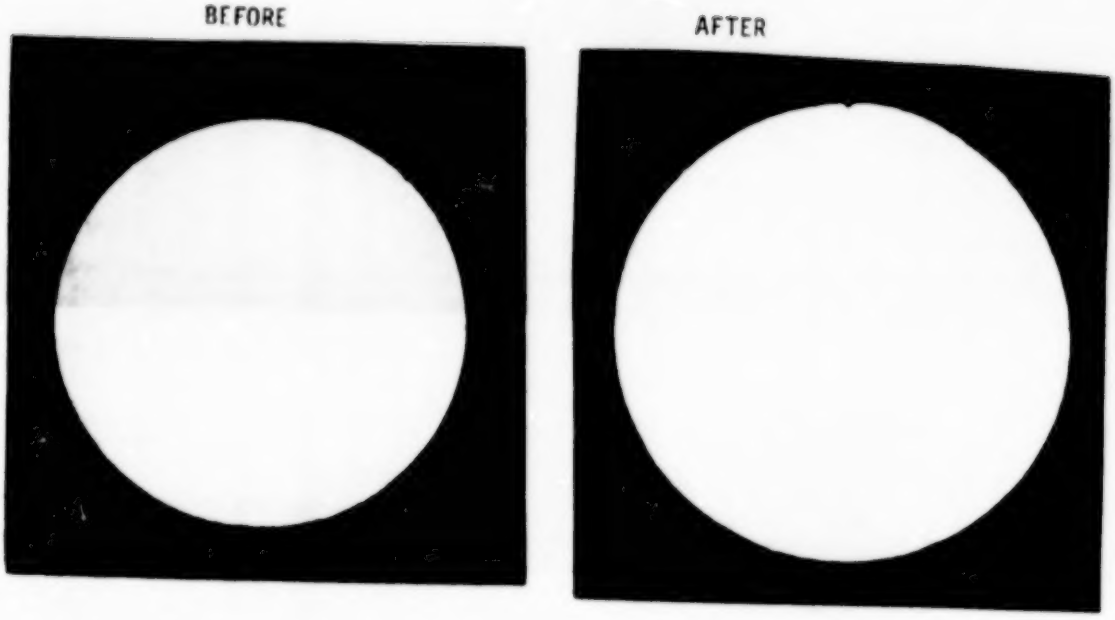


FIGURE 2 (Con't)



IFICE
No.

10

ONTARIO**RESEARCH**
FOUNDATION

ENERGY

energy conservation programs and analysis, thermal insulation design and evaluation, waste heat recovery, building energy systems and monitoring, heat storage systems, thermoelectric generation, combustion technology, burner development, heat transfer analysis, solar systems monitoring, Canadian Solar Test Facility, solar technology, wind power, coal and lignite processing, alternate fuel utilization, battery technology, energy and chemicals from biomass,

ENVIRONMENT

ambient air quality assessment, source sampling, odour emission and control, asbestos measurement and control, pesticide residues, trace metal analysis, trace organic analysis, mutagenic testing, occupational health surveys and assessments, water surveys, water purification, municipal and industrial waste water treatment processes, membrane separation techniques, wet oxidation, diesel emission control technology, solid waste treatment and recovery, noise and vibration analysis, environmental impact assessments, long-range transport of atmospheric pollutants, radiation measurements, particulate identification and measurement, ergonomics and industrial design, air pollution control technology, hazardous and toxic materials and waste control, . . .

MATERIALS

building materials, plastics, coatings and composites, metals, glass and ceramics, wood and wood composites, biomaterials, adhesives and printing inks, yarns, fabrics and geotextiles, leather, organic and inorganic chemicals, specialty formulations, specification development, quality control, mechanical chemical and thermal properties, test method development, failure analysis, fire and flammability, glass metal seals, metal and alloy powders, metallography, materials characterization by electron microscopy and X-ray microanalysis, photovoltaics and ionic conductors, corrosion properties and control, rubber technology, energy radiography, non-destructive testing, X-ray analysis, cement and concrete, gypsum, . . .

PRODUCTS & PROCESSES

pulp and paper products, clothing, footwear and industrial textile products, knitting technology, thin and thick film systems, electronic devices, microcomputer systems and applications, fibre optics, electronic design, bioengineering, ultrasonic and fluid shear devices, microwave drying, transportation and equipment testing, mathematical stress and vibration analysis, product, equipment and machinery design and development, fuel emulsification, chemistry of foodstuffs, pulping and papermaking processes, ceramics processing, metallurgical process development, powder metal technology, packaging applications, technical and economic evaluations, industrial engineering applications, electroplating, radioactive decontamination, process control, biotechnology, industrial microbiology, enzyme analysis, cryogenics, electrical testing, . . .

RESOURCES

mineral processing, hydro and pyrometallurgical processing of ferrous and non-ferrous ores, coal evaluation and processing, asbestos processing and applications, uranium processing, forest utilization, utilization of forest and agricultural wastes, utilization of industrial mining and domestic wastes, energy and chemicals from biomass, non-metallic minerals, . . .

ONTARIO RESEARCH FOUNDATION • SHERIDAN PARK, MISSISSAUGA, ONTARIO, CANADA L5K 1B3 • 416-822-4111 • TELEX 06-982211